09/696,523

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,724,130 B1
DATED : April 20, 2004
INVENTOR(S) : Ji Su et al.

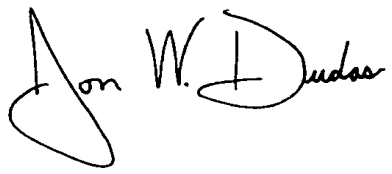
It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

The title page should be deleted and substitute therefor the attached title page as shown the attached page.

Drawings,
Replace informal figures 1 through 4 with formal figures 1 through 4 as shown on the attached pages.

Signed and Sealed this

Twenty-sixth Day of April, 2005



JON W. DUDAS
Director of the United States Patent and Trademark Office

(12) **United States Patent**
Su et al.

(10) **Patent No.: US 6,724,130 B1**
(45) **Date of Patent: Apr. 20, 2004**

(54) MEMBRANE POSITION CONTROL

(75) Inventors: **Ji Su**, Highland Park, NJ (US); **Joycelyn S. Harrison**, Hampton, VA (US)

(73) Assignee: **The United States of America as represented by the Administrator of the National Aeronautics and Space Administration**, Washington, DC (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 4 days.

(21) Appl. No.: **09/696,523**

(22) Filed: **Oct. 23, 2000**

Related U.S. Application Data

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(51) **Int. Cl.**[7] **H01L 41/08**
(52) **U.S. Cl.** **310/330**; 310/331
(58) **Field of Search** 310/328, 367, 310/368, 330, 331, 332, 324

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,803,274	A	* 4/1931	Sawyer	310/330
2,540,412	A	* 2/1951	Adler	310/330
2,842,685	A	* 7/1958	Peterman et al.	310/331
2,900,536	A	* 8/1959	Palo	310/330
3,093,710	A	* 6/1963	Eycke	310/330
3,146,367	A	* 8/1964	Mcnaney	310/331
3,904,274	A	* 9/1975	Feinleib et al.	310/328
3,928,778	A	* 12/1975	Ivanov et al.	310/331
4,246,447	A	* 1/1981	Vorie	179/110 A
4,330,730	A	* 5/1982	Kurz et al.	310/331
4,523,120	A	* 6/1985	Assard et al.	310/331 X
4,578,613	A	3/1986	Posthuma de Boer et al.	
4,868,447	A	9/1989	Lee et al.	
5,162,811	A	11/1992	Lammers et al.	
5,338,997	A	* 8/1994	Benecke	310/331 X
5,414,594	A	* 5/1995	Patusch et al.	359/846
5,440,320	A	8/1995	Lach et al.	
5,598,050	A	* 1/1997	Bowen et al.	310/322
5,689,380	A	* 11/1997	Um	310/328
5,886,811	A	* 3/1999	Min	359/291
6,074,067	A	6/2000	Shimada	
6,076,770	A	6/2000	Nygren	
6,098,349	A	8/2000	Zheng	
6,131,698	A	10/2000	Reyland	
6,188,160	B1	* 2/2001	Main et al.	310/317
6,293,682	B1	* 9/2001	Kawaguchi	359/871
6,297,579	B1	* 10/2001	Martin et al.	310/330

OTHER PUBLICATIONS

Carlin, "Lightweight Mirror Systems for Spacecraft—An Overview of Material & Manufacturing Needs," Sep. 2000, 2000 Areospace Conf. Proc. vol. 4 pp. 169–181.*

Y. Bar–Cohen et al, "NASA/JPL Workshop on Biomorphic Explorers for Future Missions", held at Jet Propulsion Labs, Pasadena, CA, Aug. 19–20, 1998, 22 pgs.

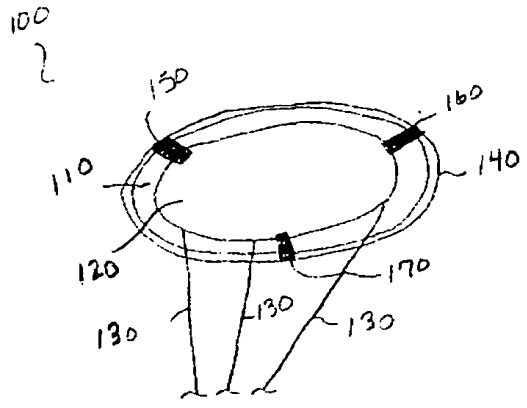
(List continued on next page.)

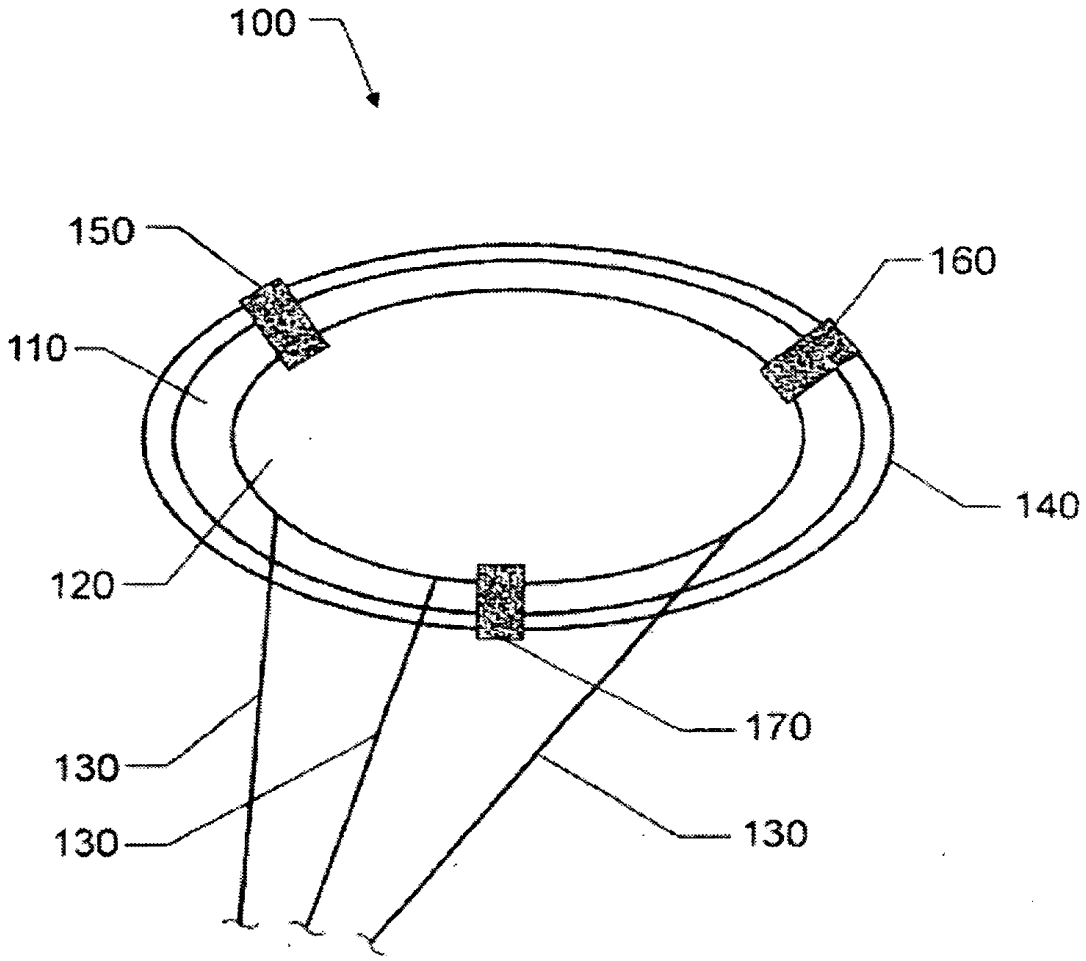
Primary Examiner—Mark Budd
(74) *Attorney, Agent, or Firm*—Robin W. Edwards

(57) **ABSTRACT**

A membrane structure includes at least one electroactive bending actuator fixed to a supporting base. Each electroactive bending actuator is operatively connected to the membrane for controlling membrane position. Any displacement of each electroactive bending actuator effects displacement of the membrane. More specifically, the operative connection is provided by a guiding wheel assembly and a track, wherein displacement of the bending actuator effects translation of the wheel assembly along the track, thereby imparting movement to the membrane.

6 Claims, 4 Drawing Sheets

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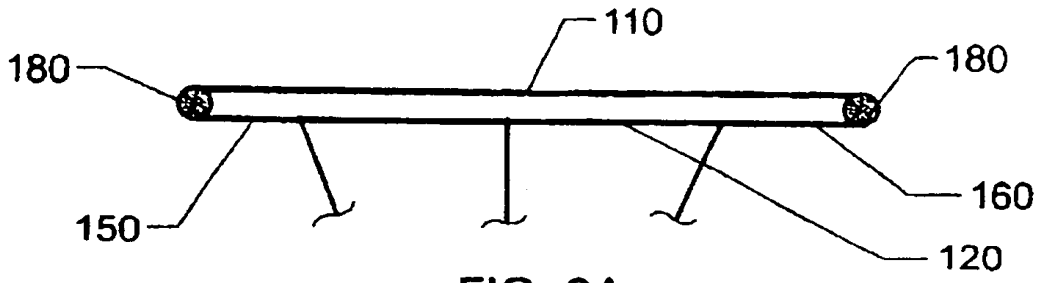

FIG. 2A

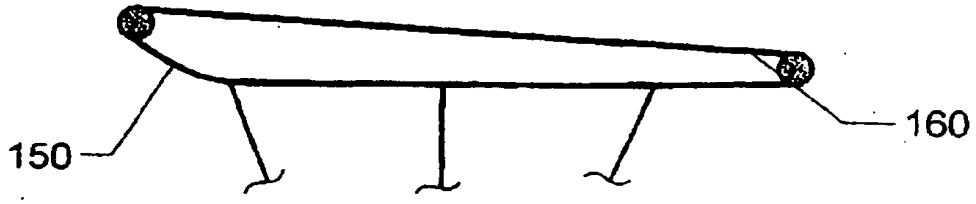

FIG. 2B

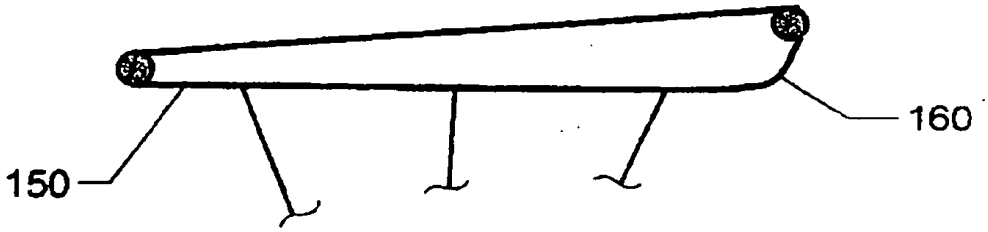

FIG. 2C

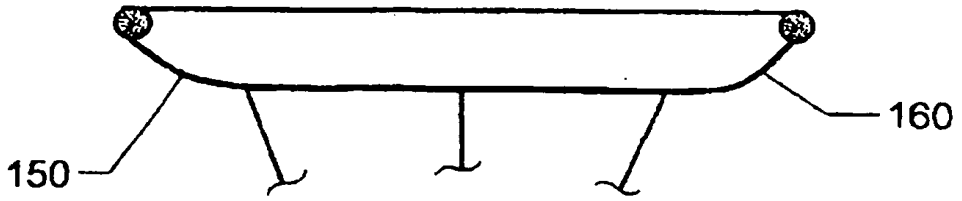

FIG. 2D

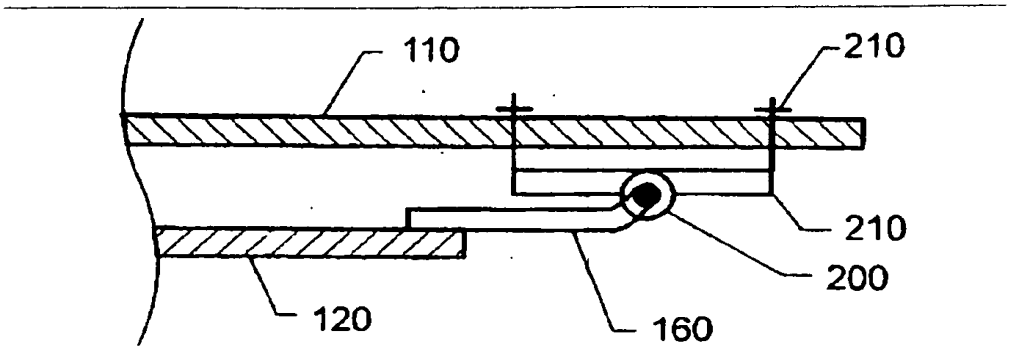

FIG. 3A

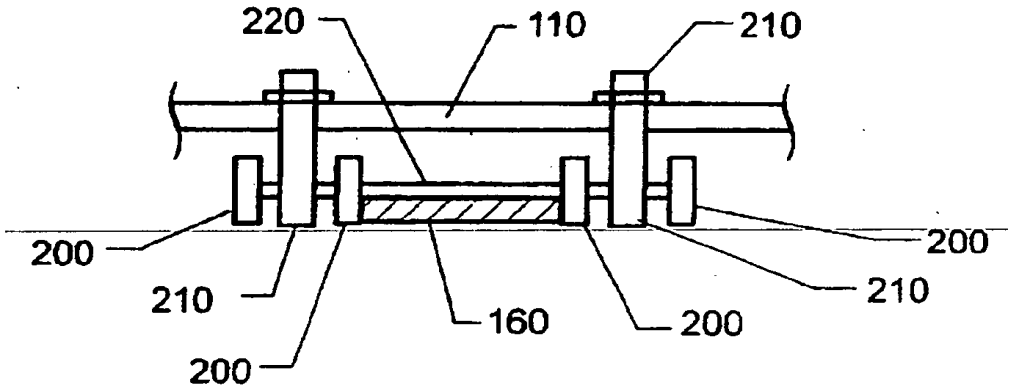

FIG. 3B

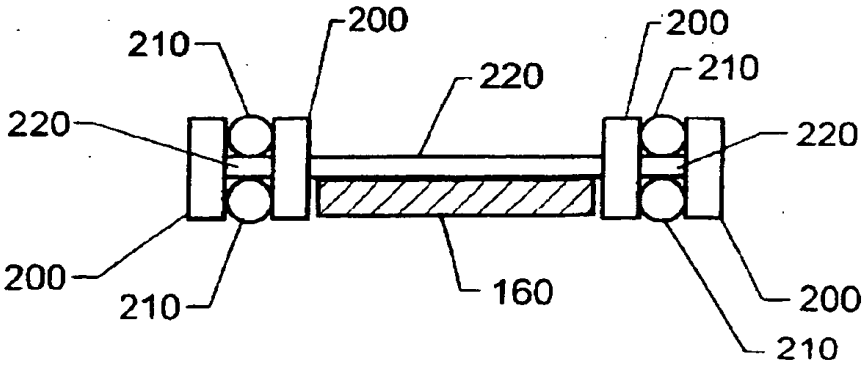

FIG. 3C

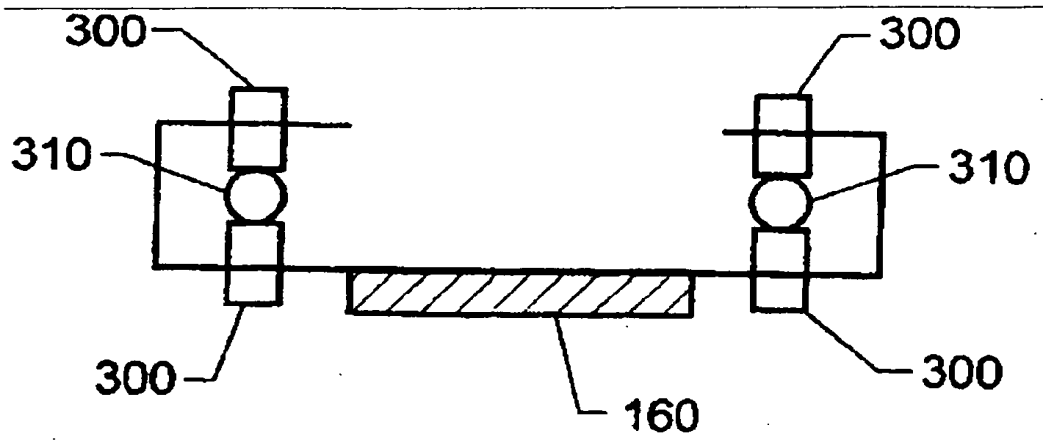

FIG. 4